ESTD. 1939

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY
"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
Approved by AICTE & UGC
Permanently Affiliated and Autonomous Institution Under
Visvesvaraya Technological University, Belagavi
www.git.edu

ESTD. 1979

2018-19 Scheme

Department: Computer Science and Engineering

Programme: B.E. in Computer Science and Engineering

3rd to 8th Semester Scheme of Teaching and Examination

Detailed Syllabi of 7th and 8th Semesters

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

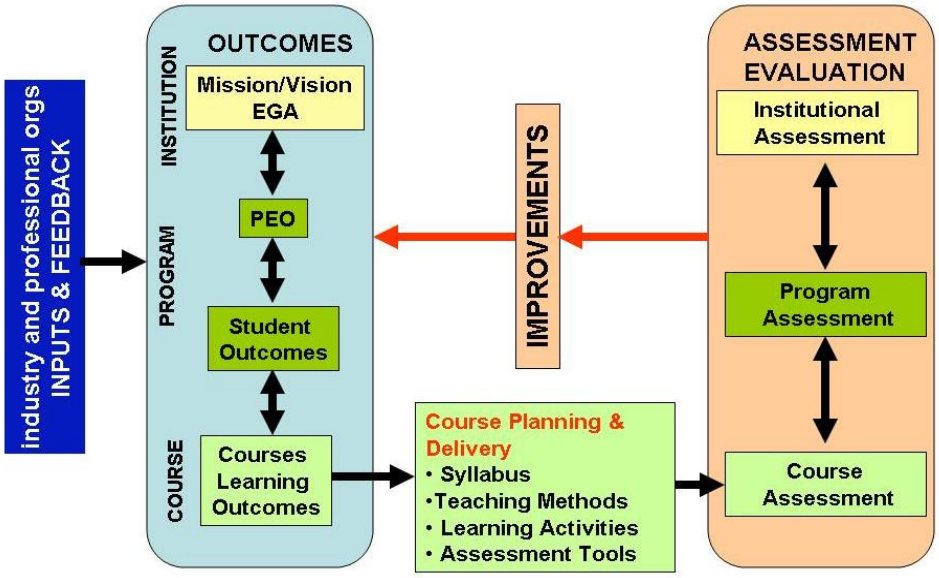
DEPARTMENT VISION

To be a center of excellence for education, research and entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society.

MISSION

To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs):

National Board of Accreditation (NBA) has framed the Program Outcomes (PO) based on twelve Graduate Attributes (GA). These POs are generic to engineering education and applies to all branches of Engineering.

1.Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2.Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.

3.Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. The graduates will acquire core competence in basic-science and engineering fundamentals necessary to identify, formulate, analyze, and solve complex engineering problems.
2. The graduates will acquire capabilities to succeed as Computer Science and Engineering professionals with an aptitude for higher education and entrepreneurship.
3. The graduates will have the curiosity and desire for lifelong learning, self-confidence and ability to adapt to changes.
4. The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills and work as part of teams on multidisciplinary projects.

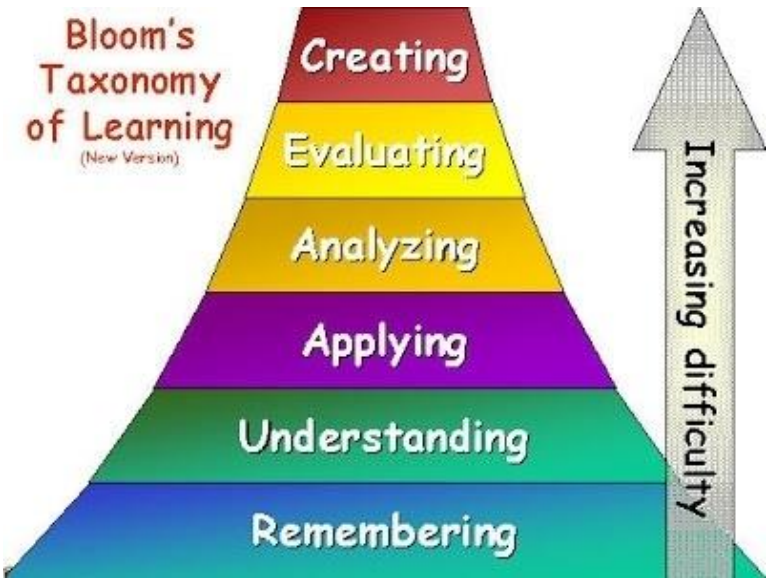
PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **Problem solving skills:** Ability to identify and analyze problems of varying complexity and propose solutions by applying fundamental knowledge acquired in the field of Computer Science and Engineering.
2. **Project development skills:** Ability to apply design principles and demonstrate best practices of software development processes to solve real life problems.
3. **Carrier advancement:** Ability to demonstrate professional and leadership qualities required to pursue opportunities in Information Technology/self-employment/ higher studies.

BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills(LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills(HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

As per the guidelines of UGC CBCS the courses can be classified into:

(i) Core Courses (PC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

(ii) Foundation Courses: The Foundation Courses are of two kinds:

Compulsory Foundation: These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

The courses are: **Basic Science Courses (BS), Engineering Science Courses (ES)**.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

An elective may be **Discipline Centric (PE)** or **Open Elective (OE).**

(iv) Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining B.E Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for B.E program

Total credits for B.E Program: 175 credits

		Regular batch		Dip. Lateral entry	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	20	40	----	----
	2	20		----	
2nd year	3	24	48	24	48
	4	24		24	
3rd year	5	24	48	24	48
	6	24		24	
4th year	7	23	39	23	39
	8	16		16	
	Total	**175**	**175**	**135**	**135**

Credit definition:

Lecture (L):One Hour /week – 1 credit
Tutorial (T): Two hour /week – 1 credit
Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

Third Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18MATCS31	Statistical- Numerical – Fourier Techniques	BS	4 – 0 – 0	4	4	50	50	100
2	18CS32	Data Structures with C	PC	4 – 0 – 0	4	4	50	50	100
3	18CS33	Digital Electronics	PC	3 – 2 – 0	5	4	50	50	100
4	18CS34	Object Oriented Programming with Java	PC	3 – 0 – 0	3	3	50	50	100
5	18CS35	Computer Organization	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL36	Web Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL37	Data Structures with C Laboratory	LAB	0 – 0 – 2	3	1	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	0 – 0 – 2	3	1	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	1	25	25	50
		Total			**31**	**24**	**350**	**350**	**700**

Third Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS31	Calculus, Fourier Analysis and Linear Algebra	BS	4 – 0 – 0	4	4	50	50	100
2	18CS32	Data Structures with C	PC	4 – 0 – 0	4	4	50	50	100
3	18CS33	Digital Electronics	PC	3 – 2 – 0	5	4	50	50	100
4	18CS34	Object Oriented Programming with Java	PC	3 – 0 – 0	3	3	50	50	100
5	18CS35	Computer Organization	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL36	Web Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL37	Data Structures with C Laboratory	LAB	0 – 0 – 2	3	1	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	0 – 0 – 2	3	1	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	1	25	25	50
		Total			**31**	**24**	**350**	**350**	**700**

Fourth Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18MATCS41	Discrete Mathematical Structures and Graph Theory	BS	4 – 0 – 0	4	4	50	50	100
2	18CS42	Operating System	PC	4 – 0 – 0	4	4	50	50	100
3	18CS43	Database Management System	PC	4 – 0 – 0	4	4	50	50	100
4	18CS44	Design and Analysis of Algorithm	PC	3 – 0 – 0	3	3	50	50	100
5	18CS45	Software Engineering	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL46	Python Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL47	Algorithms Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL48	Database Applications Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS49	Environmental Science	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**30**	**24**	**350**	**325**	**675**

 # MNC: Mandatory Non-credit course. Pass in this course is mandatory for the award of degree.

Fourth Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS41	Graph Theory and Discrete Mathematical Structures	BS	4 – 0 – 0	4	4	50	50	100
2	18CS42	Operating System	PC	4 – 0 – 0	4	4	50	50	100
3	18CS43	Database Management System	PC	4 – 0 – 0	4	4	50	50	100
4	18CS44	Design and Analysis of Algorithm	PC	3 – 0 – 0	3	3	50	50	100
5	18CS45	Software Engineering	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL46	Python Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL47	Algorithms Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL48	Database Applications Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS49	Environmental Studies	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**30**	**24**	**350**	**325**	**675**

 # MNC: Mandatory Non-credit course. Pass in this course is mandatory for the award of degree.

Fifth Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18CS51	Computer Networks	PC	3 – 2 – 0	5	4	50	50	100
2	18CS52	Object Oriented Modeling and Design	PC	3 – 0 – 0	3	3	50	50	100
3	18CS53	Unix System Programming	PC	4 – 0 – 0	4	4	50	50	100
4	18CS54	Formal Languages and Automata Theory	PC	3 – 2 – 0	5	4	50	50	100
5	18CS55X	**Professional Elective-I**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS56X	**Open Elective – I (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL57	Unix System Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL58	Software Design And Modeling Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS59A	Employability Skills-I	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**32**	**24**	**400**	**350**	**750**

Fifth semester (Regular)			
Course Code	**Professional Elective I**	**Course Code**	**Open Elective I (only for other branches)**
18CS551	Advanced Web Programming	18CS561	NoSQL
18CS552	Advanced JAVA 2-0-2 Scheme	18CS562	Enterprise Resource Planning
18CS553	Advanced Algorithms	18CS563	Project Management
18CS554	Data Warehousing and Data Mining	18CS564	Principles of Cyber Security

Fifth Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS51	Numerical Methods and Probability	BS	4 – 0 – 0	4	4	50	50	100
2	18CS52	Object Oriented Modeling and Design	PC	3 – 0 – 0	3	3	50	50	100
3	18CS53	Unix System Programming	PC	4 – 0 – 0	4	4	50	50	100
4	18CS54	Formal Languages and Automata Theory	PC	3 – 2 – 0	5	4	50	50	100
5	18CS55X	**Professional Elective-I**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS56X	**Open Elective – I (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL57	Unix System Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL58	Software Design and Modeling Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS59	Communicative English	HS	2 – 0 – 0	2	MNC	**25**	-	25
10	18CS59A	Employability Skills-I	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**33**	**24**	**425**	**350**	**775**

**** One Course exemption in 5th semester for Diploma lateral entry students to maintain the same credits as regular. (Computer Networks – exempted for Diploma students)**

Fifth Semester (Diploma)			
Course Code	**Professional Elective I**	**Course Code**	**Open Elective I (only for other branches)**
18CS551	Advanced Web Programming	18CS561	NoSQL
18CS552	Advanced JAVA 2-0-2 Scheme	18CS562	Enterprise Resource Planning
18CS553	Advanced Algorithms	18CS563	Project Management
18CS554	Data Warehousing and Data Mining	18CS564	Principles of Cyber Security

Sixth Semester									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18CS61	Artificial Intelligence and Machine Learning	PC	3 – 2 – 0	5	4	50	50	100
2	18CS62	Compiler Design	PC	3 – 2 – 0	5	4	50	50	100
3	18CS63	Embedded Systems and IoT	PC	3 – 0 – 0	3	3	50	50	100
4	18CS64X	**Professional Elective-II**	PE	3 – 0 – 0	3	3	50	50	100
5	18CS65X	**Professional Elective-III**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS66X	**Open Elective – II (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL67	Machine Learning Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL68	Embedded Systems and IoT Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS69	Constitution of India, PE and HV	HS	1 – 0 – 0	1	1	25	25	50
10.	18CS69A	Employability Skills-II	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**32**	**24**	**425**	**375**	**800**

Sixth Semester					
Course Code	**Professional Elective II**	**Course Code**	**Professional Elective III**	**Course Code**	**Open Elective II (only for other branches)**
18CS641	Computer Graphics	18CS651	Digital Image Processing	18CS661	Python Programming
18CS642	Big Data Management	18CS652	Information and Network Security	18CS662	Database Management System
18CS643	System Software	18CS653	Introduction to Salesforce (Industry Supported Elective) 2-0-2 scheme	18CS663	Data Structures
18CS644	Software Testing	18CS654	Mobile Computing	18CS664	Object Oriented Programming with JAVA
18CS645	Robotic Process Automation (Industry Supported Elective)				

Seventh Semester									
S.No.	**Code**	**Course**		**Contact Hours**	**Total Contact**	**Total credits**	**Marks**		
				L – T – P	**Hours/week**		**CIE**	**SEE**	**Total**
1	18CS71	Entrepreneurship and Management	HS	3 – 0 – 0	3	3	50	50	100
2	18CS72	Network Programming	PC	3 – 0 – 0	3	3	50	50	100
3	18CS73	Distributed Computing	PC	3 – 2 – 0	5	4	50	50	100
4	18CS74X	**Professional Elective-IV**	PE	3 – 0 – 0	3	3	50	50	100
5	18CS75X	**Professional Elective-V**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS76X	**Open Elective – III (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL77	Network Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL78	Mobile Application Development Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS79	**Seminar on Project synopsis (Design Thinking Approach) Project Phase -1**	**PC**	0 – 0 – 2	2	1	25	--	25
		Total			**28**	**23**	**375**	**350**	**725**

Project Phase -1: CIE- 25 marks (Average of 25 marks –Internal guide and 25 marks- presentation)

Seventh Semester					
Course Code	**Professional Elective IV**	**Course Code**	**Professional Elective V**	**Course Code**	**Open Elective III (only for other branches)**
18CS741	Cloud Computing	18CS751	System Simulation and Modeling	18CS761	Software Testing
18CS742	Soft Computing	18CS752	Storage Area Networks	18CS762	Web Programming
18CS743	Block Chain Management	18CS753	Agile Software Development	18CS763	Machine Learning
18CS744	Ad-Hoc Sensor Networks	18CS754	Service Oriented Architecture	18CS764	Big Data and Hadoop
18CS745	*Industry Supported Elective (2-0-2 scheme)				

* Salesforce Lightning

Eighth Semester									
S.No.	**Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18CS81	Internship	PC(INT)			2	50	--	50
2	18CS82	Intellectual Property Rights	HS	Self-Study		1	50	--	50
3	18CS83	Professional Certification – 1 (English / any other foreign language)	HS			1	25	--	25
4	18CS84	Professional Certification – 2	PC			1	25	--	25
5	18CS85	Project Phase -2	PC			2	50(25+25)	--	50
6	18CS86	Project Phase -3	PC			4	50(25+25)	--	50
7	18CS87	Project Phase-4 (Final Viva Voce)	PC	Final		5	--	100	100
		Total				**16**	**250**	**100**	**350**

Internship: 6 to 8 weeks duration

Project Phase -2 and 3: CIE- 50 marks (25 marks –Internal guide + 25 marks- presentation)

7th Semester Detailed Syllabi

Entrepreneurship and Management

Course Code	**18CS71**	**Credits**	03
Course type	HS	**CIE Marks**	50 marks
Hours/week: L-T-P	3–0–0	**SEE Marks**	50 marks
Total Hours:	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand the Characteristics of management, Role of Management, Importance and Purpose of Planning, Organizing, Staffing, directing and Controlling
2. To understand Meaning of entrepreneur, Development of Entrepreneurship.
3. To understand Source of New Idea, Ideas into Opportunities. Creative Problem Solving
4. To apply the aggregate planning strategies.
5. Understanding of the different Schemes like Make in India, Start Up India, Digital India

Unit - I — 8 Hours

Management: Introduction, nature and characteristics of Management, Scope and Functional areas of management, Levels of management.

Planning: Nature, importance and purpose of planning process, Types of plans, Decision making, Importance of planning, steps in planning

Organizing: Nature and purpose of organization, Principles of organization, Types of organization, Span of control.

Self-learning topics: Management as a science, art of profession

Unit - II — 8 Hours

Staffing: Nature and importance of staffing, Process of Selection & Recruitment, Training Methods.

Directing: Meaning and nature of directing, Leadership styles, Motivation Theories, Communication-Meaning and importance.

Controlling: Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control.

Unit - III — 8 Hours

Entrepreneur: Meaning of entrepreneur: Evolution of the concept: Functions of an Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship, Evolution of Entrepreneurship, The Entrepreneurial Culture and Stages in entrepreneurial process.

Creativity and Innovation: Creativity, Source of New Idea, Ideas into Opportunities, Creative Problem Solving: Heuristics, Brainstorming, Synectics, Significance of Intellectual Property Rights.

Self-learning topics: Case studies of Entrepreneurs

Unit - IV **8 Hours**

Micro, Small and Medium Enterprises [MSMEs] and Institutional Support: Business environment in India**,** Role of MSMEs**,** Government policies towards MSMEs, Impact of Liberalization, Privatization and Globalization on MSMEs.

Institutional support: NSIC, TECKSOK, KIADB, KSSIDC, SIDBI; KSFC

Self-learning topics: Make in India, Start Up India, Digital India

Unit - V **8 Hours**

Preparation of project: Meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report.

Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation

Books

1. Henry Koontz: ―Essentials of Management‖ Latest Edition
2. Poornima.M. Charantimath: Entrepreneurship Development – Pearson Education – 2014 Edition
3. Donald Kuroki and Richard ―Entrepreneurship in new Millennium‖ South Western Carnage Learning
4. N V R Naidu, ―Management & Entrepreneurship‖- IK International, 2008
5. P.C. Tripathi, P.N. Reddy ―Principles of Management‖ — Tata McGraw Hill.
6. Dr.M.M. Munshi, Prakash Pinto and Ramesh Katri ―Entrepreneurial Development‖ Himalaya Publishing House, 2016.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. To explain the Functions of management, Characteristics of Management, Importance and Purpose of Planning, organizing, staffing, directing and controlling	L1
2. To explain Meaning of entrepreneur, Development of Entrepreneurship and steps in developing entrepreneurship.	L2, L3
3. To describe Source of New Idea, Ideas into Opportunities. Creative Problem Solving etc.	L4
4. Describe the different Schemes like TECKSOK, KIADB etc. and also Make in India, Start Up India, Digital India concepts	L2, L3

Program Outcome of this course (POs)	**PO No.**
1. An ability to communicate effectively.	7
2. A recognition of the need for and an ability to engage in lifelong learning.	9
3. An ability to use the techniques, skills, and modern engineering tools necessary for	11

	Course delivery methods		Assessment methods
1.	Lecture	1.	Quiz
2.	Videos	2.	IA
3.	PPT	3.	Assignment/case study presentation
4.	Field study		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Network Programming

Course Code	18CS72	Credits	3
Course type	PC	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Illustrate working with Network Programming on Unix compliant operating systems.
2. Demonstrate programming with TCP, UDP and SCTP.
3. Evaluate advanced Socket Programming APIs.

Pre-requisites: Unix system Programming and Computer Networks

Unit – I — 8 Hours

Introduction: Introduction, Client/server communication, OSI Model, BSD Networking history, Test Networks and Hosts, Unix Standards, 64-bit architectures.
Transport Layer: TCP, UDP and SCTP, TCP Connection Establishment and Termination.

Self learning topics: TCP/IP Protocols in nut shell.

Unit – II — 8 Hours

Sockets Introduction: Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering and Manipulation Functions.
Elementary TCP Sockets: socket, connect, bind, listen, accept, fork and exec, Concurrent Server design, getcsockname and getpeername functions.
Self learning topics: TCP Echo Client/Server Functions.

Unit – III — 8 Hours

Elementary UDP Sockets: recvform and sendto Functions, UDP Echo Client/Server- main, dg_echo and dg_cli Functions, Lost Datagrams, Verifying received Responses, Server Not Running, connect Function with UDP, Lack of Flow control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server using select.
Elementary SCTP Sockets: Interface Models, shutdown function, Notifications.
Self learning topics: STCP One-to-Many-Style Streaming Echo Client and Server main Functions.

Unit – IV — 8 Hours

Advanced Sockets 1
Ipv4 and IPv6 Interoperability: IPv4 Client and IPv6 Server, IPV6 Client ad IPv4 Server, IPv6 Address-Testing Macros, Source Code Portability
Daemon Processes: syslogd Daemon , syslog Function.
Self learning topics: daemon_init Function, inetd Daemon daemon_inetd Function.

Unit – V — 8 Hours

Advanced Sockets 2
Broadcasting: Introduction, Broadcast Addresses, Unicast vs Broadcast, dg_cli Function using Broadcasting, Race Conditions.
Multicasting: Introduction, Multicast Addresses, Multicast vs Broadcast on a LAN, Multicast on a WAN, Source-Specific Multicast.

Self learning topics: Multicast Socket Options , SNTP

Books

Text Book

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004 and onwards.

Reference Books

1. Barry Nance: "Network Programming in C", PHI 2002 3.Bob Quinn, Dave Shute: "Windows Socket Network Programming", Pearson 2003 and onwards.
2. Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition 2006 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** the basics of Unix Network Programming.	L2
2.	**Develop** networking applications that communicate with each other using TCP, UDP and SCTP.	L3
3.	**Demonstrate** use of APIs for advanced socket programming concepts.	L3

Program Outcome of this course (POs)		PO No.
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Distributed Computing

Course Code	**18CS73**	**Credits**	04
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-2-0	**SEE Marks**	50 marks
Total Hours	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To learn Basic Concepts of Distributed Systems
2. To understand File Sharing, Distributed File System implementation
3. To understand the concepts of Cryptanalysis, Access control
4. To learn Basic concepts of Cloud Computing

Pre-requisites: Basic Computer Concepts, Operating Systems.

Unit – I 10 Hours

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling.
System Model: Architectural Models, Fundamental models.
Self-learning topics: Security Models

Unit – II 10 Hours

Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication.
Distributed Object and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications.

Unit – III 10 Hours

Distributed File System: Introduction, File Service architecture.
Security in distributed systems: Introduction, Overview of security techniques: Cryptography, Certificates, Access control. Cryptographic Algo: Symmetric: Ex Substitution algo. , Asymmetric: RSA.

Unit – IV 10 Hours

Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states.
Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections.

Unit – V 10 Hours

Introduction to Cloud Computing: Introduction, Network Centric computing and Network Centric Content, Peer to Peer Systems, Cloud Computing: An old idea Whose Time has Come,
Cloud Computing: Delivery Models and Services, Ethical Issues in Cloud Computing, Cloud Vulnerabilities, Major Challenges Faced by Cloud Computing.
Self-learning topics: Case Studies: Amazon Web Studies

Books

Text Books

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems Concepts and Design, Pearson Education, Third edition
2. Dan Marinescu : Cloud Computing Theory and Practice, ELSEVIER

Reference Books

1. Kai Hwang, Geofrey C, Fox, Jack J, Dongarra: Distributed and Cloud Computing From Parallel processing to the Internet of Things.
2. Sunita Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010.

Course Outcome (COs)

At the end of the course, the student will be able to**:**		**Bloom's Level**
1.	**Explain** the Shared memory concepts.	L2
2.	**Explain** the advantages of Distributed File Systems.	L2
3.	**Analyze** mechanisms to manage security in Distributed systems.	L4

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Assignments
2.	PPT	2.	Internal Tests
		3.	Quiz
		4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Cloud Computing

Course Code	**18CS741**	**Credits**	03
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand various basic concepts related to cloud computing technologies
2. To learn how to use Cloud Services and provide solutions for business process management
3. To understand the concepts related to virtualization technology
4. To get acquainted with various cloud simulation tools

Pre-requisites: Distributed Computing

Unit – I 8 Hours

Introduction: Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
Cloud Deployment models: Cloud characteristics, Measured Service, Cloud deployment models, security in a public cloud, public verses private clouds, cloud infrastructure self-service.

Unit – II 8 Hours

Cloud as a service: Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service defined.
Cloud solutions: Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.

Unit – III 8 Hours

Cloud virtualization technology: Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization.

Unit – IV 8 Hours

Cloud Management: Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.

Unit – V 8 Hours

Cloud Computing with the Titans: Google, EMC, NetApp. Microsoft, Amazon, Salesforce.com, IBM.

Books

Text Book

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011 and onwards.

2. Cloud Computing a practical Approach by Anthony T. Velte, Tobe J. Velte and Robert Elsenpeter, McGrawHill 2010 and onwards.

Reference Book

1. Cloud Computing Principles and Paradigms by RajkumarBuyya, Wiley India 2011 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Discuss** cloud computing and control considerations within cloud computing environments.	L2
2. **Identify** various cloud services.	L2
3. **Explain** various concepts related to virtualization.	L2
4. **Demonstrate** of various cloud simulation tools.	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	8

Course delivery methods		**Assessment methods**	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Soft Computing

Course Code	18CS742	Credits	03
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours:	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce the principles behind soft computing techniques.
2. To design and develop system that use Neural Network and Fuzzy Logic.
3. To introduce genetic approach in solving computationally hard problems.

Pre-requisites: Discrete Mathematical Structures, Probability and Statistics

Unit – I 08 Hours

Introduction: Neural networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing.

Artificial Neural Network: An Introduction, Fundamental Concepts, Evolution of Neural Networks, Basic Models of Artificial Neural Networks, Important Terminologies of ANNs, McCulloch- Pitts Neuron, Linear Separability, Hebb Network.

Unit – II 08 Hours

Supervised Learning Network: Perceptron Networks: Perceptron Learning Rule, Perceptron Training Algorithm for single Output Classes, Adaptive Linear Neuron (Adaline): Delta Rule for Single Output Unit, Back-Propagation Network..

Associative Memory Networks: Bidirectional Associative Memory (BAM), Hopfield Networks.

Unit – III 08 Hours

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Introduction to Fuzzy Logic, Classical Sets (Crisp Sets), Fuzzy Sets, Properties of Fuzzy sets.

Classical Relations and Fuzzy Relations: Classical Relation: Operations on Classical Relations, Fuzzy Relations: Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Composition.

Unit – IV 08 Hours

Membership Functions: Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments.

Defuzzification: Defuzzification Methods.

Unit – V 08 Hours

Genetic Algorithm: Introduction, What are Genetic Algorithm?, Why Genetic Algorithms?, Genetic Algorithm and Search Space: Evolution and Optimization, Basic Terminologies in Genetic Algorithms, Operators in Genetic Algorithms: Encoding, Selection, Crossover (Recombination), Mutation.

Books

Text Book

1. S.N. Sivanandam, S.N. Deepa , Principles of Soft Computing, 2nd Edition Wiley Publisher.

Reference Book

1. Patnaik, Srikanta, Zhong, Baojiang (Eds.), Soft Computing Techniques in Engineering Applications, Springer 2014.

Course Outcome (COs)

At the end of the course, the student will be able to:		Bloom's Level
1.	Design Neural Network to solve problems in a variety of engineering domains.	L6
2.	Design systems that employ fuzzy control approach.	L6
3.	Device systems that employ genetic algorithm and demonstrate their working.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2

Course delivery methods		Assessment methods	
1.	Lecture	1.	Assignments
2.	PPT	2.	Internal Tests
		3.	Quiz
		4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Block Chain Management

Course Code	18CS743	Credits	03
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce basics of blockchain
2. To create Smart contract with Ethereum
3. To design Web UI for decentralized apps
4. To implement Identity, privacy and security techniques

Pre-requisites: Distributed Systems

Unit – I 08 Hours

On Decentralization: Why decentralization matters Examples of failures due to centralized systems Some of the half-measures used to fix centralization

Docker and Cryptography: Fundamental cryptography concepts: symmetric keys, asymmetric keys and hashes, Utilizing OpenSSL to understand cryptography concepts,Using Docker and Docker Compose to deploy simple applications

Blockchain Revolution: Public blockchains, and the problem they solve Shortcomings of public blockchains addressed by permissioned blockchains, Components of a typical blockchain

Unit – II 08 Hours

Blockchain basics: From Bitcoin to Blockchain; Blockchain programming; UML blockchain design models; Blockchain node installation and management

Smart contracts: The concept of a smart contract; Design of a smart contract; Development of smart contract code; Deploying and testing the smart contract; Decentralized airline system use case; Airlines smart contract; Motivating decentralized scenarios; Smart contract design considerations; Best practices

Unit – III 08 Hours

Techniques for trust and integrity: Essentials of trust and integrity; Implementing trust intermediation; Testing; Establishing trust with modifiers, require(), revert(), and assert(); Best practices

From smart contracts to Dapps: Preliminary concepts; Dapp development using the Truffle IDE; Installing the Ganache test chain; Smart contract development; Dapp web application development; Introspection; Best practices

Unit – IV 08 Hours

Security and privacy: Deploying smart contracts on Ropsten; Cryptography basics; Application of public key cryptography; Hashing basics; Application of secure hashing; Introspection; Best practices

On-chain and off-chain data: On-chain data; Blind auction use case; Off-chain data: External data sources; ASK airline system; Introspection; Best practices

Unit – V 08 Hours

Web3 and a channel Dapp; Going public with infura; decentralized file systesm(IPFS)

Blockchain data analytics; Blockchain protocols and platforms; Blockchain business use cases

Books

Text Book

1. Bina Ramamurthy, Blockchain in Action, Manning, 1st Edition, 2020
2. Mansoor Ahmed-Rengers, Marta Piekarska-Geater, Permissioned Blockchain in Action, Manning, 1st Edition, 2021

Reference Book

1. Roberto Infante, Exploring Ethereum Dapps, Manning, 1st Edition, 2019

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Compare** and contrast blockchain with other distributed systems	L2
2.	**Build** Smart contract with Ethereum and the Solidity language	L3
3.	**Develop** Web UI for decentralized apps	L3
4.	**Apply** Identity, privacy and security techniques	L3
5.	**Understand** On-chain and off-chain data storage	L2

	Program Outcome of this course (POs)	PO No.
1.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
2.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
		3.	IA Test

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Ad-Hoc Sensor Networks

Course Code	**18CS744**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understand how the wireless medium impacts design of ad-hoc sensor network protocols, and the specific challenges that need to be solved
2. Classify and compare MAC layer protocols for Ad Hoc networks, and WSNs
3. Analyze the design of routing protocols for Ad Hoc Sensor Networks for different objectives
4. Introduce modifications necessary to classical TCP and QoS models for Ad-Hoc networks.

Pre-requisites: Computer Networks, Layered Design, MAC Protocols – CSMA/CD, Transport Protocols – TCP Flow and Congestion Control

Unit – I 8 Hours

Introduction: Application examples, Types of applications, Challenges for WSNs, Why are sensor networks different – MANETs and WSNs, Energy scavenging, Microcontroller energy consumption, Relationship between computation and communication, Some examples of sensor nodes.

Unit – II 8 Hours

MAC Protocols: Introduction, Issues, Design goals, Classifications, Contention-Based Protocols – MACAW, Contention-Based Protocols with Reservation Mechanism – D-PRMA, Low duty cycle protocols and wakeup concepts – S-MAC, Schedule-based protocols – LEACH

Self-learning topics: IEEE 802.11 DCF Back off mechanism

Unit – III 8 Hours

Routing Protocols: Introduction, Issues, Classifications, Table-Driven Routing Protocols – DSDV, On-Demand Routing Protocols – DSR, AODV, Hybrid Routing Protocols – ZRP, Routing Protocols with efficient flooding mechanism – OLSR, Hierarchical Routing Protocols – FSR

Self-learning topics: Localization and Positioning, Topology control

Unit – IV 8 Hours

Transport Protocols: Introduction, Issues, Design goals, Classification, TCP over Ad Hoc Networks – A brief revisit, Why TCP does not perform well in Ad Hoc Networks, Feedback-based TCP, TCP with ELFN, Other Transport Layer Protocols – ACTP, Ad Hoc Transport Protocol.

Self-learning topics: Coverage and deployment problems

Unit – V 8 Hours

Quality of Service: Introduction, Issues and Challenges, Classifications, MAC layer solutions – IEEE 802.11e EDCF, Network layer solutions – Predictive Location-Based QoS Routing Protocol, QoS Frameworks – QoS Models, QoS Resource Reservation Signaling

Self-learning topics: QoS in Multihop Wireless Networks

Books

Text Book

1. C. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education, Second Edition and onwards

Reference Book

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons Ltd, First Edition and onwards

E-resources

1. Jangeun Jun, M. L. Sichitiu, The Nominal Capacity of Wireless Mesh Networks, https://ieeexplore.ieee.org/document/1241089
   https://www.ab9il.net/wlan-projects/wireless-mesh-network-capacity.pdf

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** why ad-hoc sensor networks are different, energy consumption challenges, and their applications.	L1, L2
2.	**Classify and Compare** different MAC layer protocols for Ad Hoc Networks, and Wireless Sensor Networks.	L2
3.	**Interpret** design of routing protocols for Ad Hoc Networks based on different objectives.	L2
4.	**Contrast** design of TCP over Ad Hoc Networks with classical design.	L2
5.	**Identify** QoS design challenges by the layer where it is implemented.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3.	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Student Assignments
2.	Presentations	2.	Internal Assessment Test
3.	Remedial classes	3.	Semester End Examination
4.	Group assignments/seminars		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE: 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

System Simulation and Modeling

Course Code	**18CS751**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	38	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring out importance of simulation and simulation components in engineering problems
2. To introduce mathematical and statistical models in continuous and discrete distributions
3. To present random number generation methods and tests for random number
4. To realize the importance of analysis of simulation data and validation of simulation models

Pre-requisites: Engineering Mathematics, Discrete mathematics

Unit – I 8 Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation, Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Simulation examples: Simulation of queuing systems(single server and two server), Simulation of (M,N) inventory system.

General Principles, Simulation Software: Concepts in Discrete-Event simulation: The event-scheduling / time-advance algorithm.

Unit – II 8 Hours

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions: Binomial distribution, Poisson distribution; Continuous distributions: Uniform distribution, Exponential distribution, Triangular distribution.

Unit – III 8 Hours

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers: frequency tests;

Random-Variate Generation: Inverse transform technique: Exponential distribution, Uniform distribution, Triangular distribution.

Unit – IV 8 Hours

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Selecting input models without data.

Unit – V 6 Hours

Verification, Calibration, Validation and Optimization

Model building, verification and validation; Verification of simulation models; Calibration and validation of models, input-output validation using historical input data.

Books

Text Book

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 4th Edition onwards, Pearson Education, 2010.

Reference Books

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Classify** and compare simulation models.	3
2.	**Solve** simulation problems on queuing, inventory systems.	3
3.	**Identify** types of distribution and apply statistical models for simulation.	3
4.	**Construc**t random number generator and test for the random numbers	4
5	**Explain** validation and verification models	2

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
4.	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	4

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5	Class Room Exercises	5.	Course Project (Mini project)

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15=30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out 0f 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Storage Area Networks

Course Code	18CS752	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3 – 0 – 0	SEE Marks	50 marks
Total Hours:	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To study Storage Area Networks characteristics and its components.
2. Introduce storage virtualization and bring out its importance.
3. Analyse different networked storage options for different application environments

Pre-requisites: Basic knowledge of computer networks, Operating system

UNIT I 8 hours

Introduction to information storage and management: Information Storage, Evolution of Storage Technology and Architecture , Data Centre Infrastructure , Key Challenges in Managing Information , information lifecycle

Concepts of storage Networking: Data storage and data access problem

UNIT II 8 hours

Data Protection: RAID 5: Implementation of RAID, RAID Array Components , RAID Levels , RAID Comparison , RAID Impact on Disk Performance ,hot spares

UNIT III 8 Hours

Storage Area Networks: Fibre Channel,The SAN and Its Evolution , Components of SAN , FC Connectivity.

Network Attached Storage: General-Purpose Servers vs. NAS Devices , Benefits of NAS , NAS File I/O , Components of NAS

UNIT IV 8 Hours

Storage Virtualization: Definition of Storage virtualization, Implementation Considerations, Storage virtualization on Block or file level, Storage virtualization on various levels of the storage Network, Symmetric and Asymmetric storage virtualization in the Network

UNIT V 8 hours

Application and case studies of Storage Area Networks: Applying the SAN to OLT P workloads, Applying SAN to Web based applications, Applying SAN to Data ware house models. Case study: The import Auto industry

Books

Text Books

1. EMC Corporation, “Information Storage and Management”, Wiley India, 2nd Edition, 2011
2. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 2003

Reference Books

1. Richard Baker and Paul Masssiglia 2002 "Storage Area Networks Essential A complete guide to understanding and implementing SANS", John Wiley India
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2nd Edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Describe** information storage and management	L2
2.	**Apply** storage area network solutions to enhance performance of the network	L3
3.	**Compare** performance of different RAID levels	L2

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
		4.	Course Seminar / Project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out 0f 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Agile Software Development

Course Code	**18CS753**	**Credits**	**3**
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring the importance/need for Agile Software Development.
2. To apply the principles and practices of agile software development on a project of interest and relevance to the student.
3. To learn about user stories and agile estimation and planning techniques.

Pre-requisites: Software Engineering

Unit - I — 8 Hours

Introduction: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor, The XP Lifecycle, The XP Team, XP Concepts, Adopting X.P

Unit - II — 8 Hours

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Impressions, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Iteration Demo, Reporting.

Unit - III — 8 Hours

Releasing: NoBugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership and Documentation.

Unit - IV — 8 Hours

Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.

Unit - V — 8 Hours

Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Books

Text Books:

1. The Art of Agile Development by James Shore and Shane Warden, O'Reilly, 2007 first edition onwards

Reference Books:

1. Succeeding with Agile : Software Development Using Scrum, Pearson (2010)
2. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Apply a thorough understanding of Agile principles and specific practices	L3
2.	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems	L3
3.	Evaluate likely successes and formulate plans to manage likely risks or problems	L4

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Quiz
2.	PPT	2.	Assignments
3.	Videos	3.	IA Test

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Service Oriented Architecture

Course Code	18CS754	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce the concepts of Service Oriented Architecture.
2. To introduce the key issues in SOA and architectural abstractions.
3. To present the technique of integrating SOA technologies with Web Services paradigms.
4. To give an insight into related technologies and implementation basics of SOA.

Pre-requisites: Web Programming

Unit – I 8 Hours

Introduction to SOA: Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, Comparing SOA with N-tier architecture, The continuing evolution of SOA, The roots of SOA

Unit – II 8 Hours

Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP. Web Services and Contemporary SOA: Message exchange patterns- Service activity coordination- Atomic transactions- Business activities-Orchestration-Choreography.

Unit – III 8 Hours

Service orientation and security: Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies Metadata exchange- Security- Notification and eventing. SOA and Service-Orientation: Principles of Service-Orientation-Service-orientation. Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation

Unit – IV 8 Hours

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA Deriving business services- Service- Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches

Unit – V 8 Hours

Service-oriented design: Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SOA Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

Books

Text Books

1. Thomas Erl , “Service-Oriented Architecture: Concepts, Technology & Design”, Pearson Education Pt. Ltd. 2008

2. Michael Rosen, Boris Lublin sky, Kevin T. Smith, Marc J. Balcer, "Applied SOA: Service Oriented Architecture and Design Strategies", Wiley, 2010.

Reference Books

1. Thomas Erl, "SOA Principles of Service Design" Pearson Exclusives 2007
2. Tomas Erl and Grady Booch, "SOA Design Patterns" Prentice Hall 2008

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Illustrate** the importance of SOA.	L2
2. **Illustrate** the significance of SOA primitives.	L2
3. **Analyze** the quality web services.	L4

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Internal assessment
2.	Power Point Presentations	2.	Assignment
3.	Demonstration	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Software Testing

Course Code	**18CS761**	**Credits**	03
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring the importance/need for Software Engineering
2. To introduce the terminology, testing, test-case, pseudo-codes / algorithms / flowcharts of Triangle & Commission programs
3. To develop the skill of analyzing the Triangle & Commission programs, with the perspective of Boundary Value Analysis, Equivalence Class & Decision Table Testing paradigms
4. To practice quality assurance related processes / methods / standards

Pre-requisites: Database Management Systems, Software Engineering, Graph Theory

Unit - I 8 Hours

Introduction: Professional Software Development: Software Engineering, Software Engineering Diversity, Software Engineering ethics. **Software Process**: Software Process models: The Waterfall model, Incremental development. Process activities: Software specification, Software design and implementation, Software validation.

Self-learning topics: Coping with Change: Prototyping, Incremental Delivery, Boehm's Spiral Model

Unit - II 8 Hours

A Perspective on Testing:

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. **Examples:** Generalized pseudocode, The triangle problem,

Self-learning topics: The commission problem.

Unit - III 8 Hours

The SATM (Simple Automatic Teller Machine) problem, The currency converter.

Boundary value analysis: Boundary value analysis: Generalizing Boundary Value Analysis, Limitations of Boundary Value Analysis, Robustness testing, Worst-case testing, Special value testing, Examples: Guidelines for Boundary Value Testing

Unit – IV 8 Hours

Equivalence Class Testing: Equivalence classes, Equivalence test cases for the triangle problem and the commission problem, Guidelines and observations.

Decision Table–Based Testing: Decision tables, Test cases for the triangle problem.

Self-learning topics: Decision tables for the commission problem

Unit - V 8 Hours

Path Testing, Data Flow Testing:

DD paths, Test coverage metrics: Metric Based Testing, Basis path testing: McCabe's Basis Path Method, guidelines and observations. Definition-Use testing. Guidelines and observations.

Self-learning topics: Observations on McCabe's Basis Path Method , Essential Complexity

Books

Text Books

1. Ian Sommerville: Software Engineering, Pearson Education, 9th Edition and onwards.
2. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.

Reference Books

1. Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Recall** the professional & ethical responsibilities of Software Engineering.	L1
2.	**Define** the test-case, testing, error taxonomy	L1
3.	**Illustrate** test-cases for Triangle, NextDate & Commission programs, for boundary value analysis.	L2
4.	**Design** test-cases for Triangle, NextDate & Commission programs, for equivalence class testing, decision table testing.	L3
5.	**Demonstrate** the importance of verification & validation in improving the process of software development**.**	L3
6.	**Examine** the testing, verification and validation for an application.	L4

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
4.	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-Point presentations	2.	Quizzes
3.	Online Videos/Learning	3.	Internal Assessment Tests
4.	NPTEL/Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Web Programming

Course Code	18CS762	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand HTML and design web pages
2. To utilize JavaScript for interactive pages on the client side.
3. To understand server side programming and that can be deployed on any device.

Pre-requisites: Computer Concepts and C Programming, Database Management Systems, Web Programming

Unit – I **08 Hours**

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.
Self learning topics: Built-In Directives

Unit – II **08 Hours**

CSS: XHTML (continued): Lists, Tables, Forms, Frames
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.
Self learning topics: Built-In Directives

Unit – III **08 Hours**

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

Unit – IV **08 Hours**

Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

Unit – V **08 Hours**

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

Books

Text Books

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson education, 2008
2. Simon Holmes, Getting MEAN: Mongo, Express, Angular, Node, Dreamtech press, 2015, 1st Edition and onwards
3. HTML and CSS: Design and Build Websites, Jon Duckett

Reference Books

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 3rd Edition, Pearson education
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006
3. Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003

Course Outcome (COs)

At the end of the course, the student will be able to**:**	**Bloom's Level**
1. **Explain** basic concepts of Web programming	L2
2. **Describe** usage of HTML and CSS	L2
3. **Implement** simple applications with HTML, CSS and Javascript	L3
4. **Implement** simple server side programs using php	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Internal Assessment Test
2.	Demonstration	2.	Assignment
3.	Hands on	3.	Quiz
4.	Presentation	4.	Programming Exercises

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Machine Learning

Course Code	18CS763	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand the basic concepts of learning and decision tree
2. To understand neural networks and genetic algorithms
3. To understand Bayesian techniques
4. To understand learning through emergent behavior

Pre-requisites: Algorithms, Probability theory

Unit - I — 8 Hours

Introduction to Machine Learning: Introduction, Training Rote Learning, Learning Concepts, General-to-Specific Ordering, Version Spaces, Candidate Elimination, Inductive Bias, Decision-Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Learning Neural Networks, Supervised Learning, Unsupervised Learning, Reinforcement Learning

Unit – II — 8 Hours

Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Recurrent Networks, Unsupervised Learning Networks, Evolving Neural Networks

Unit – III — 8 Hours

Probabilistic Reasoning and Bayesian Belief Networks: Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes' Optimal Classifier, The Naïve Bayes Classifier, Collaborative Filtering.

Unit – IV — 8 Hours

Artificial Life-Learning through Emergent Behavior: Introduction, What Is Life?, Emergent Behavior, Finite State Automata, Cellular Automata, Evolution, Evolution Strategies, Genetic Programming, Evolutionary Programming, L-Systems, Classifier Systems, Artificial Immune Systems.

Unit – V — 8 Hours

Genetic Algorithms: Introduction, Representations, The Algorithm, Fitness, Crossover, Mutation, Termination Criteria, Optimization of a Mathematic Function, Why Genetic Algorithms Work, Messy Genetic Algorithms, Prisoner's Dilemma, Diversity, Evolving Pictures, Predators and Coevolution, Other Problems.

Books

Text Book

1. Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlet Publishers, 1st Edition, 2004.

Reference Books

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013
2. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013
3. T Hastie, R. Tibshirani, J.H.Fiedman, "The Elements of statistical learning", Springer, 1st Edition 2001

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. Choose the learning techniques with this basic knowledge.	L3
2. Apply effectively neural networks and genetic algorithms for appropriate applications.	L3
3. Apply bayesian techniques and derive effectively learning rules.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Project (Mini project)

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Big Data and Hadoop

Course Code	18CS764	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3 – 0 – 0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand Big data dimensions and its applications with case studies.
2. To explore Hadoop framework and architecture.
3. To understand the importance of MapReduce framework.
4. To explore PIG Architecture and functionalities.

Pre-requisites: Database Management System, Data Mining

Unit – I 8 Hours

Understanding Big Data: What is big data?: Characteristics of Big Data, Data in the Warehouse and Data in Hadoop; Why is Big Data Important? : When to consider a Big Data solution? Big Data Use Cases: Patterns for Big Data Deployment

Unit – II 8 Hours

The History of Hadoop: Components of Hadoop, Hadoop Distributed File System, The Basics of Map Reduce Hadoop Common Components, HDFS Shell Commands: Hadoop Architecture, Notable Hadoop Related Projects.

Unit – III 8 Hours

Application Development in Hadoop: PIG and PigLatin, Hive, Jaql, Hadoop Streaming Getting your data into Hadoop: Basic Copy Data, Flume, Other Hadoop Components: Zookeeper, HBase, Oozie, Avro

Unit – IV 8 Hours

Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Uses of MapReduce.

Unit – V 8 Hours

PIG: Introduction to PIG, The PIG Architecture, Benefits and Limitations of PIG, Properties of PIG, Differences between PIG vs Map Reduce, PIG Latin: Basic Operations (DUMP, LOAD, STREAM, GROUP, JOIN), Grunt, PIG's data model: scalar types(int, long, float, double, chararray, bytearray) and complex types(Map, Tuple, Bag, Nulls, Casts).

Books

Text Books:

1. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 https://www.ibm.com/developerworks/vn/library/contest/dw.freebooks/Tim_Hieu_Big_Data/Understanding_BigData.PDF.
2. TomWhite,"Hadoop:TheDefinitiveGuide",ThirdEdition,O'Reilly,2012.
3. EricSammer,"HadoopOperations",O'Reilly,2012.

Reference Books:

1. VigneshPrajapati,BigdataanalyticswithRandHadoop,SPD2013
2. Alan Gates,"ProgrammingPig", O'Reilly, 2011

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Outline** the importance of Big Data, its characteristics and use of Big Data in different fields/sectors.	L1
2. **Explain** the ecosystem of Hadoop	L2
3. **Apply** map reduce framework in analyzing the data and relate to YARN	L3
4. **Explain** usage of PIG Language in analyzing the data and managing Big Data	L2

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Project (Mini project)
		6.	Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Network Programming Laboratory

Course Code	**18CSL77**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours/2 Hours for 50 marks

Course learning objectives

1. To practice the students for network programming in UNIX based operating systems
2. To design and simulate the network in latest simulation tools
3. To illustrate message controlling mechanisms
4. To Perform the real time network traffic analysis using network monitoring tools

Pre-requisites: Computer Network, Network Programming and Unix System Programming

List of experiments

1. Implementing IPC using Pipes and message queues.
2. Implementing client server communication using socket programming that uses connection oriented protocol at transport layer.
3. Implement the distance vector routing algorithm
4. Using WIRESHARK observe the data transferred in client server communication using UDP and identify the UDP datagram.
5. Using WIRESHARK analyze three way handshaking connection establishment, data transfer and connection termination in client server communication using TCP.
6. Simulate a Full duplex connection in an wired network using NS3.
7. Simulate a simple Wireless UDP application using NS3.
8. Simulate a simple 5G Network application using NS3.
9. Understanding the working of Ipv6 in Low power lossy network
10. Understanding the working of IoT routing using RPL protocol

Books

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: “UNIX Network Programming”. Volume 1, Third Edition, Pearson 2004.
2. Barry Nance: “Network Programming in C”, PHI 2002 3.Bob Quinn, Dave Shute: “Windows Socket Network Programming”, Pearson 2003.
3. Richard Stevens: “UNIX Network Programming”. Volume 2, Second Edition.
4. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Develop Inter Process Communication and client server communication using Pipes, Sockets and message queues.	L3
2. Implement message controlling mechanisms encryption.	L3
3. Design and Analyze network traffic using network simulation and monitoring tools	L4

Program Outcome of this course (POs)	**PO No.**
1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations	3
3. Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations	5

Assessment methods	
1.	Lab IA
2.	Lab journal evaluation
3.	Day today Lab Conduction from students

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: **20/50 (10/25)**		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Mobile Application Development Laboratory

Course Code	**18CSL78**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours	30	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To introduce the Android and its architecture
2. To develop the activity life cycle, views, layouts and events
3. To introduce SQLite and Ionic Frameworks

Pre-requisites: Java Programming

List of experiments

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Develop an application that makes use of database.
5. Develop an application that makes use of notification.

Books

1. Android Studio 3.5 Development Essentials, Java Edition, 2019 Neil Smyth / Payload Media, Inc
2. Build Mobile Apps with Ionic 2 and Firebase, Fu Cheng, apress
3. Ionic Cookbook, Hoc Phan, Packt Publishing

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** basic concepts and anatomy of an Android application	L2
2. **Apply** design principles for interactive client side web pages	L2
3. **Design** and **develop** cross-platform apps for native iOS, Android and the web.	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Assessment methods	
1.	IA Test
2.	Mini Project
3.	Periodic Journal Evaluation

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20/50 (10/25)		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Course Code: 18CS81	Internship	Total credits	2
Course type: PC(INT)	CIE Marks : 50 marks	SEE Marks	NIL

At the End of the sixth / Seventh semester Research/Industrial Internship shall be carried. All the students admitted shall have to undergo a mandatory internship of 6-8 weeks during the vacation of 6^{th} / 7^{th} semesters. A Viva-Voce examination shall be conducted during 7^{th} /8^{th} semester and the prescribed credit shall be included in 8^{th} semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent semesters.

Course Outcome (COs)

At the end of the course, the student will be able to		Learning Level	PO(s)
1.	articulate and apply principles learned in the classroom to a specific internship site experience.	L3	PO1
2.	develop work competencies for a specific profession or occupation.	L3	PO2
3.	present thoughts and ideas clearly and effectively in written and oral forms as required for particular workplace settings.	L3	PO10
4.	gain self-understanding, self-confidence, develop interpersonal skills, develop effective work habits, including time management, punctuality, and personal accountability.	L3	PO10
5.	explore career options and gain general work experience.	L5	PO12

Scheme of Continuous Internal Evaluation (CIE):

- Internship shall be evaluated for 50 marks as Continuous Internal Evaluation and no SEE.
- Continuous Internal Evaluation for a total of 50 marks will be awarded by internal guide, external guide, and the department committee.
- The department shall schedule for the presentation which will be evaluated by a team of faculty members.
- The evaluation could be done at the beginning of 7^{th} /8^{th} semester and marks for the grades could be submitted in 8^{th} sem.
- The student shall submit FOUR COPIES of the final report for SEE. After completion of the viva-voce, signed copy of the report shall be submitted to student, internal guide, external guide and the department library.

Internal guide marks	External guide marks	Presentation marks	Final Marks
15	25	10	50

Course Code: 18CS82	Intellectual Property Rights (IPR)	Total credits	1
Course type: HS	CIE Marks: 50 marks	SEE Marks	NIL

Students have to undergo 6-8 weeks of IPR certification course NPTEL/SWAYAM/WIPO/VTU. They can take this certification course anytime from 3rd - 8th semester. The prescribed credit shall be included in 8th semester. The certification shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the certification shall be declared fail and shall have to complete during subsequent semesters.

Course Outcome (COs)

At the end of the course, the student will be able to		Learning Level	PO(s)
1.	get an adequate knowledge on patent, copyrights, etc., and related documents, and professional ethics	L2	PO8
2.	Apply procedural knowledge related to patent.	L3	PO8

- IPR Certification course shall be evaluated for 50 marks as Internal Evaluation and no SEE.
- Internal Evaluation for a total of 50 marks will be awarded by the department committee. The scores are based on the performance evaluation done by the organisation offering the certification course.
- Student shall submit the copy of the assessment report and the certificate to the mentor/guide.

Course Code:18CS83	Professional Certification -1 (Language Certification)	Total credits	1
Course type: HS	CIE Marks : 25 marks	SEE Marks	NIL

Students have to undergo English/any other foreign language certification course offered by INSTITUTE/NPTEL/SWAYAM. They can take this certification course anytime from 3rd - 8th semester. To encourage the students to write competitive exams, TOEFL/IELTS qualified certificate will also be considered. The prescribed credit shall be included in 8th semester. The certification shall be considered as a head of passing and shall be considered for the award of *degree. Those, who do not take up/complete the certification shall be declared fail and shall have to complete during subsequent semesters.

Course Outcome (COs)

At the end of the course, the student will be able to		Learning Level	PO(s)
1.	develop vocabulary and improve the accuracy in grammar	L3	PO10
2.	improve LSRW- listening, speaking, reading and writing skills	L3	PO10
3.	speak with more confidence and enhance their professionalism at work	L3	PO10

- Certification course shall be evaluated for 25 marks as Internal Evaluation and no SEE.
- Internal Evaluation for a total of 25 marks will be awarded by the by the department committee. The scores are based on the performance evaluation done by the organisation offering the certification course.
- Student shall submit the copy of the assessment report and the certificate to the mentor/guide.

Course Code:18CS84	Professional Certification - 2	Total credits	1
Course type: PC	CIE Marks : 25 marks	SEE Marks	NIL

Students have to undergo 6-8 weeks of certification course offered by NPTEL/SWAYAM/NASSCOM /Industry-Institute partnered certification. They can take this certification course anytime from 3rd – 8th semester. The list of the online courses will be given by the departments. Also, to encourage the students to write competitive exams, GATE qualified certificate will also be considered. The prescribed credit shall be included in 8th semester. The certification shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the certification shall be declared fail and shall have to complete during subsequent semesters.

Course Outcome (COs)

At the end of the course, the student will be able to		Learning Level	PO(s)
1.	acquire additional knowledge in current field	L2	PO12
2.	upskill themselves for the professional growth of their career	L3	PO12
3.	abreast with the new technologies in the industries and boost their competencies	L3	PO12

- Certification course shall be evaluated for 25 marks as Internal Evaluation and no SEE.
- Internal Evaluation for a total of 25 marks will be awarded by the by the department committee. The scores are based on the performance evaluation done by the organisation offering the certification course.
- Student shall submit the copy of the assessment report and the certificate to the mentor/guide.

Course Code: 18CS79/85/86/87	Project Work	Total credits	12

This course will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. A single discipline or a multidisciplinary project can be assigned to an individual student or a group having not more than 4 students. Students can take it up in the same institute / out of the institute at reputed research organizations / Institutes/Industries. All the students shall have to select the project during 7^{th} semester. A Viva-Voce examination shall be conducted during $7^{th}/8^{th}$ semester and the prescribed credit shall be included in $7^{th}/8^{th}$ semester. The project work shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent semesters whenever this course is offered.

Progress of the project work is monitored and evaluated in four phases as:

- 7^{th} semester: Project Phase -1,
- 8^{th} semester: Project Phase -2, Project Phase -3, and Project Phase - 4 (Final viva voce).

Course Outcome (COs)

At the end of the course, the student will be able to		Learning Level	PO(s)
1.	Identify, analyze and formulate projects with a comprehensive and systematic approach.	L4	PO2
2.	Summarize the literature review, analyze previous work and relate them to current project.	L4	PO2, PO4
3.	Use and apply fundamental knowledge and skills in engineering on the project.	L3	PO1
4.	Use of modern tools (software/hardware) which are applicable to the industries.	L3	PO5, PO12
5.	Design and develop a functional product/prototype/software while working in a team.	L6	PO3, PO6, PO7, PO8
6.	Working efficiently and constructively in a project team.	L3	PO 9
7.	Present the objectives, methodology and results using good oral and written presentation skills.	L3	PO 10, PO11

Scheme of Continuous Internal Evaluation

Continuous Internal Evaluation is done by the project guide and the project evaluation committee nominated by the department. Evaluation is based on the relevance to the project, objectives, work done and the presentation (in the form of report and oral presentation).

Semester	Component	Guide marks	Project Evaluation Committee marks	Total marks
7th	Project Phase - 1: Seminar on Project synopsis		25	25
8th	Project Phase - 2	25	25	50
8th	Project Phase - 3	25	25	50

Semester End Examination:

Semester	Component	Total marks
8th	Project Phase - 4: Brief Write-up, Project Presentation and Project Viva Voce	100